WHAT IS CLAIMED IS:

1. A method of forming at least one quantum dot on a predetermined area of a substrate, comprising:

forming a nucleation site comprising at least one surface or subsurface defect at the predetermined area of the substrate by implantation with ions; and

growing a quantum dot on the nucleation site.

2. The method of claim 1, wherein the quantum dot is formed on the nucleation site by strained layer epitaxy.

3. The method of claim 1, wherein the implantation of ions is performed using a focused ion beam.

4. The method of claim 3, wherein the ions are selected from a group consisting of gallium, silicon and gold ions.

5. The method of claim 4, wherein the gallium ions are implanted using a beam energy in a range of about 1 keV to about 50 keV, a beam current of about 10pA, and an exposure time in a range of about 10 microsec to about 10 msec.

6. The method of claim 4, wherein a dosage of the gallium ions is in a range of about 10^{13} to about 10^{16} gallium ions per cm^2.

7. The method of claim 1, wherein the nucleation site comprises a spot formed on the substrate, and the diameter of the spot is less than about 80 nm.

8. The method of claim 1, further comprising annealing the substrate after implantation.

9. The method of claim 8, wherein the annealing is performed at a temperature in the range of about 550 °C to about 750 °C.

10. The method of claim 1, wherein the substrate is a Si substrate.

11. The method of claim 10, wherein the step of growing a quantum dot on the nucleation site comprises growing a Ge island on the Si substrate by strained layer epitaxy.

12. The method of claim 11, wherein the Ge island is grown by introducing digermane gas onto the substrate at a substrate temperature in a range of about 550 °C to about 650 °C and digermane pressure in a range of about 10^{-8} Torr to about 10^{-6} Torr.

13. The method of claim 1, further comprising encapsulating the quantum dot.

14. The method of claim 13, wherein the step of encapsulating comprises forming an overgrowth layer over the substrate and the quantum dot.

15. The method of claim 1, further comprising:

prepatterning the substrate to form at least one prepatterned area.

16. The method of claim 15, wherein the location of the nucleation site is determined based on the at least one prepatterned area.

17. A method of forming a semiconductor device, comprising:

forming a nucleation site at a predetermined area of a semiconductor device layer by implantation with ions, the nucleation site comprising at least one surface or subsurface defect at the predetermined area; and

growing a quantum dot on the nucleation site.

18. The method of claim 17, wherein the quantum dot is formed on the nucleation site by strained layer epitaxy.

19. The method of claim 17, wherein the semiconductor device is an optoelectronic device.

20. The method of claim 17, wherein the implantation of ions is performed using a focused ion beam.

21. The method of claim 20, wherein the ions are selected from the group consisting of gallium, silicon and gold ions.

22. The method of claim 21, wherein the gallium ions are implanted using a beam energy in a range of about 1 keV to about 50 keV, a beam current of about 10pA, and an exposure time in a range of about 10 microsec to about 10 msec.

23. The method of claim 21, wherein a dosage of the gallium ions is in a range of about 10^{13} to about 10^{16} gallium ions per cm^2.

24. The method of claim 17, wherein the nucleation site comprises a spot formed on the semiconductor device layer, and the diameter of the spot is less than about 80 nm.

25. The method of claim 17, further comprising annealing the semiconductor device layer after implantation.

26. The method of claim 25, wherein the annealing is performed at a temperature in the range of about 550 °C to about 750 °C.

27. The method of claim 17, wherein the substrate is a Si substrate and the step of growing a quantum dot on the nucleation site comprises growing a Ge island on the Si substrate by strained layer epitaxy.

28. The method of claim 27, wherein the Ge island is grown by introducing digermane gas onto the substrate at a substrate temperature in a range of about 550 °C to about 650 °C and digermane pressure in a range of about 10^{-8} Torr to about 10^{-6} Torr.

29. The method of claim 17, further comprising encapsulating the quantum dot.

30. The method of claim 29, wherein the step of encapsulating comprises forming an overgrowth layer over the semiconductor device layer and the quantum dot.

31. The method of claim 17, further comprising:

prepatterning the semiconductor device layer to form at least one prepatterned area.

32. The method of claim 31, wherein the location of the nucleation site is determined based on the at least one prepatterned area.